CLAIMS

1. A molten metallic bath for treating steel consisting essentially of:

greater than 10 to 12 total weight percent aluminum;

0.5 to 7 total weight percent magnesium; and

the remainder of the bath being zinc with inevitable impurities.

2. The bath of claim 1 wherein said magnesium is present from 1 to 5 total weight percent.

3. The bath of claim 1 wherein said magnesium is present from 2 to 4 total weight percent.

4. A molten metallic bath comprising:

greater than 10 to 12 total weight percent aluminum;

0.5 to 7 total weight percent magnesium; and

78 to 89.5 total weight percent zinc with inevitable impurities.

5. The bath of claim 4 further comprising an additive selected from the group consisting of: a metal carbide, a metal boride, and a metal boro-carbide where the metal is titanium, vanadium, silicon, aluminum and zinc.

6. The bath of claim 5 wherein said additive is present from 0.01 to 0.9 total weight percent.

7. The bath of claim 4 wherein the bath is substantially devoid of a contaminant selected from the group consisting of: mischmetal or a rare earth metal constituent thereof.

8. A corrosion resistant steel comprising:

a steel substrate miscible with molten zinc; and

an adjacent iron-aluminum intermetallic alloy layer having a top surface and a bottom surface, said iron-aluminum intermetallic layer having a thickness of greater than 1 micron.

9. The steel of claim 8 wherein said iron-aluminum intermetallic comprises at least 18% aluminum by weight.

10. The steel of claim 9 wherein said iron-aluminum intermetallic layer has a thickness greater than 2 microns.

11. The steel of claim 9 wherein said iron-aluminum intermetallic layer has a thickness greater than 5 microns.

12. The steel of claim 9 wherein said iron-aluminum intermetallic layer has a thickness greater than 10 microns.

13. The steel of claim 9 wherein said iron-aluminum intermetallic layer has a thickness greater than 12 microns.

14. The steel of claim 9 further comprising a zinc layer having an upper surface in contact with the top surface of said iron-aluminum intermetallic layer.

15. The steel of claim 14 wherein said zinc layer has a thickness of between 5 and 50 microns.

16. The steel of claim 15 wherein said zinc layer has a thickness of between 10 and 35 microns.

17. The steel of claim 9 further comprising a phosphating agent crystalline layer in contact with the upper surface of said zinc layer.

18. The steel of claim 17 wherein said phosphating agent crystalline comprises hexafluoro-titanium phosphate.

19. The steel of claim 9 further comprising an aluminum particulate filled cured epoxy overlayer adhering to said phosphating agent crystalline layer.

20. The steel of claim 9 wherein said iron-aluminum intermetallic layer is from 19 to 25 total weight percent aluminum.

21. The steel of claim 9 with the proviso that said iron-aluminum intermetallic layer is substantially devoid of rare earth metals.

22. The steel of claim 9 wherein said steel substrate is formed as a tube.

23. A process for forming a corrosion resistant steel comprising the steps of:

contacting a clean mild steel surface with a first bath comprising a majority of zinc component by weight with inevitable impurities so as to form an iron-zinc intermetallic layer; and

dipping said iron-zinc intermetallic layer into a second bath comprising from greater than 10 to 12 total weight percent aluminum, 0.5 to 7 total weight percent magnesium and a balance of said bath being zinc with inevitable impurities so as to displace at least in part said iron-zinc intermetallic layer and

form an iron-aluminum intermetallic layer having a thickness of greater than 1 micron and an overlayer of zinc-aluminum alloy.

24. The process of claim 23 wherein the step of coating the iron-zinc intermetallic layer with said second bath occurs under an inert or reducing atmosphere.

25. The process of claim 23 wherein the first bath is substantially devoid of mischmetal or a rare earth metal constituent thereof.

26. The process of claim 23 wherein said second bath is substantially devoid of mischmetal or a rare earth metal constituent thereof.

27. The process of claim 24 wherein said iron-aluminum intermetallic layer contains from 19 to 25 weight percent aluminum.

28. A steel formed by the process of claim 23.

29. The use of an iron-aluminum intermetallic layer having a thickness of at least 1 micron and overlayered with zinc to protect an underlying steel substrate.

30. The use of an iron-aluminum intermetallic layer of claim 29 wherein at least 98% by volume of said iron-aluminum intermetallic layer is iron aluminide.